

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE OUTLINE			
Course Title	Mechanics of Machines - I		
Course Code	MEPC 17	No. of Credits	3
Department	Mechanical Engineering	Faculty	K.Pannir selvam Arun Nair
Pre-requisites Course Code	Engineering Mechanics		
Course Coordinator(s) (if, applicable)			
Other Course Teacher(s)/Tutor(s) E-mail	pannik@nitt.edu arunnair@nitt.edu	Telephone No.	00431 5203412
Course Type	<input checked="" type="checkbox"/> Core course <input type="checkbox"/> Elective course		
COURSE OVERVIEW			
This course gives an insight into basics of kinematics and synthesis and analysis of mechanisms.			
COURSE OBJECTIVES			
<ol style="list-style-type: none"> 1) To impart knowledge on various types of mechanisms and their synthesis. 2) To impart skills to analyze the position, velocity and acceleration of mechanisms. 3) To familiarize higher pairs like cams and gears. 			
COURSE OUTCOMES (CO)			
Course Outcomes	Aligned Programme Outcomes (PO)		
<ol style="list-style-type: none"> 1. Synthesize and analyze 4 bar mechanisms. 2. Use computers for mechanism animation and analysis. 3. Understand cams and gears. 	1,2,5,7,11		

COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week	Topic	Mode of Delivery
1.	1	Introduction of Mechanics of Machines 1 & 2, Kinematics and Kinetics, demonstration of engineering cracker, rules of the game. Why we need machines, first known kinematician, Degrees of freedom in space and plane, types of motion. Definition of rotation, translation and complex motion. Links and their types , Introduction to joints. Lower pairs, examples, higher pairs, DoF of joints, wheel on road roll, slide, roll-slide condition.	Chalk & Talk, Demonstration
2.	2	closure, joint order, comparison of lower and higher pairs. Mobility, Gruebler criteria, calculation of mobility of mechanisms. modified gruebler equation, kutzbach equation, examples of mobility calculations. mechanism, Structure and preloaded structure classification, umbrella, introduction to number synthesis, hypothesis of odd/even	Chalk & Talk , Demonstration
3.	3	Proof of odd/even hypothesis, Number synthesis for Mobility 1 , importance of 4 bar mechanism. Combination of links for 4 bar, 6 bar, 8 bar mechanisms, Linkage transformation. working model software introduction and animations of mechanisms. inversions, isomers, Grashof condition introduction, actuators with complex motion is not there- coupler cant be a driver.	Chalk & Talk

2.	Project	14		15
3	Computer program for mechanism analysis			5
3.	End Semester Exam	15	6 hours	50

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

- 1) Robert L. Norton., " Design of Machinery: an introduction to synthesis and analysis of mechanisms and machines" 5th ed., McGraw-Hill 2012
- 2) Uicker, J.J., Jr., Pennock, G.R., and Shigley, J.E., Theory of Machines and Mechanisms ,3 ed., Oxford Univeristy Press, 2003.
- 3) Robert Norton., "Kinematic s and Dynamics of machinery" 1st ed., McGraw Hill India., 2009

9.	9	Instant center of slider crank mechanism, angular velocity ratio. Mechanical Advantage, centroids introduction and application, non circular gears. centroid video , velocity of slip and velocity of transmission. relative velocity in rotating frames	Chalk & Talk , Practical drawing session
10.	10	Problem in slider inversion involving slip and transmission. Velocity vector loop method , General acceleration of a point . velocity and acceleration analysis drafting session. velocity and acceleration analysis drafting session	Chalk & Talk
11.	11	acceleration of slider crank mechanism, effect of acceleration on human beings. coriolis acceleration ant problem, videos. Mems Gyroscope. coriolis acceleration insight General acceleration of slider.	Chalk & Talk
12.	12	acceleration analysis of shaper mechanism. methods of transmission of motion, direct contact mechanism, angular velocity ratio. Law of gears, Gear types. Gear types and their features.	Chalk & Talk, Practical drawing session
13.	13	Gear trains simple and compound. Epicyclic gear train, ferguson paradox. CAMS types , svaj diagram, law of cam design	Chalk & Talk

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Cycle Test	10	4 hours	30

4.	4	Grashoff condition, grashoff inversions, non-Grashof inversions. Special case grashof mechanisms, parallel and anti parallel mechanisms, Deltoid, square, video on grashof mechanism. Rotatability and revolvability definition, criteria for N bar linkages, springs as linkages, MEMS. Practical considerations in making links and pairs, synthesis, limiting conditions toggle	Chalk & Talk , Video
5.	5	toggle clamp, transmission angle, two position synthesis. Video on synthesis. Practice session on two position synthesis. practice session on two position synthesis	Chalk & Talk , Demonstration
6.	6	Quick return mechanism synthesis, coupler curve introduction. coupler curve synthesis video. Symmetrical 4 bar mechanisms. cognates, straight line mechanism, analysis of mechanism why? Position analysis.	Chalk & Talk, Video
7.	7	position, coordinate systems, position difference, relative position, inertial and non-inertial frames. translation, rotation and complex motion, graphical position analysis. translation, rotation and complex motion, graphical position analysis. computer program for algebraic method	Chalk & Talk
8.	8	computer program for vector loop method. position analysis of crank slider crank mechanism, velocity analysis. instant center of rotation. Instant center of rotation of 4 bar mechanism, proof of Kennedy's theorem	Chalk & Talk , Computer programming session

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

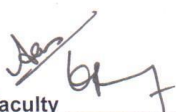

Feedback at the end of the course would be taken from the students in order to accomplish an effective learning for the students.

COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

- 1) Project must be completed by 14th week and timely reviews must be attended failing which zero marks will be awarded.
- 2) 75 % attendance is mandatory failing which the student can be prevented from writing the examination (End semester). Those students who secure marks above class average in the cycle test a relaxation of 15% attendance can be given for genuine reasons.
- 3) End semester examination involves writing as well as drawing. A duration of 6 hours is recommended for the conduct of the same.
- 4) Progress of the project will be recorded regularly in the project handbook.
- 5) The project work should be presented to the class at the end of 14th week, to disseminate the knowledge the knowledge by the student group.
- 6) Additional 3, 5 marks over and above the marks secured in cycle test and end semester examination will be allotted for asking thought provoking questions in the class. This award is given by the judgement of the concerned faculty.

ADDITIONAL COURSE INFORMATION

FOR SENATE'S CONSIDERATION

Course Faculty  CC-Chairperson  HOD 